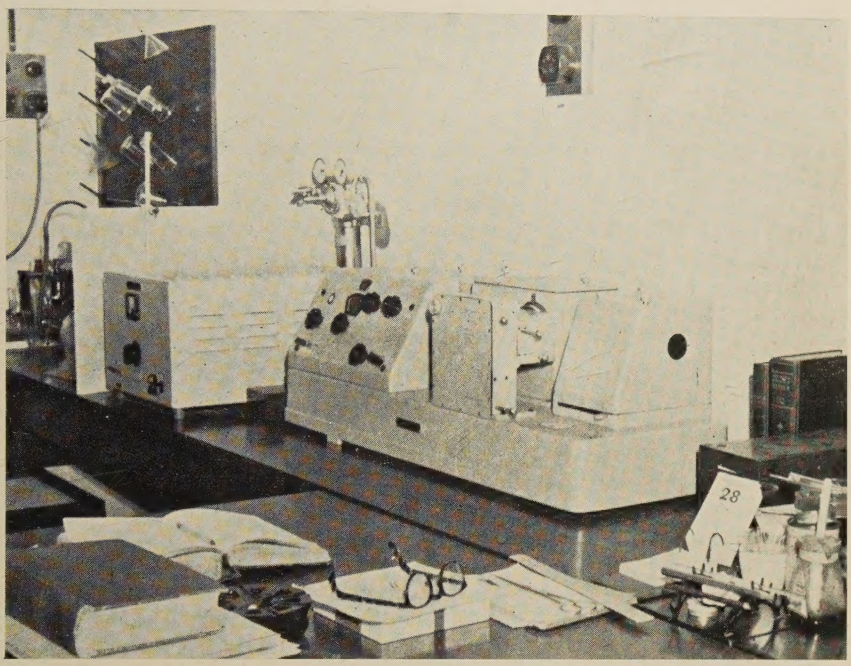
PLANTERS' BULLETIN

OF THE RUBBER RESEARCH INSTITUTE OF MALAYA



NEW SERIES NUMBER TWENTYTWO

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50 Cents

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1956

R R I

LOCATION. The institute's laboratories and offices are at the third mile, Ampang Road, Kuala Lumpur.

CORRESPONDENCE. All LETTERS must be addressed to the Director, Rubber Research Institute of Malaya, Post Office Box 150, Kuala Lumpur. Special inquiries may be marked for the attention of particular officers. The address for TELEGRAMS is Searching, Kuala Lumpur. TELEPHONE: Kuala Lumpur 3351. PARCELS occasionally arrive without any indication of their origin. Senders' names and addresses should be written clearly on the outside of all packages, and the institute should be advised of despatch by letter or telegram.

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ADVICE. Inquiries are invited from rubber producers in the Federation of Malaya, the Colonies of Singapore and North Borneo, and the territories of Sarawak, Brunei and Nigeria, who may require more detailed information applicable to their own special problems. Where it is considered necessary, visits will be made to Estates in Malaya as convenient. Visits to estates in other territories are by special arrangement. The only visits for which charges are normally made are those of the Institute's budding mandores. INTERVIEWS should be arranged by letter or telephone, as members of the senior research and advisory staff are frequently absent on visits to plantations. The institute is open from 8 am to 1 pm and 2 pm to 4 pm on Mondays to Fridays, and from 8 am to 12.30 pm on Saturdays.

EXPERIMENT STATION AND FACTORY. This station of the R R I is situated 16 miles from Kuala Lumpur, at Sungei Buloh on the Kuala Lumpur — Kepong — Kuala Selangor road. Visits may be made on Mondays or Wednesdays by arrangement. There is a guest house.

PUBLICATIONS. A list of 'Publications of the R.R.I.' is available on request. Subscription may be made by depositing $15 with us. An annual statement of account will then be submitted.

PLANTERS' BULLETIN

OF THE RUBBER RESEARCH INSTITUTE OF MALAYA

Kuala Lumpur January 1956 Number 22

Editorial: Thoughts

The turn of the year inevitably bends thoughts towards progress and achievements and to future trends and developments, and our minds have inclined this way on the subject of Natural Rubber, although we intend to offer here neither a comprehensive review of the past nor a detailed programme of future research projects. Rather have our musings raised queries which some of our readers may find reason to consider with their own New Year resolutions.

In the long run how beneficial to the producer will be the high price of natural rubber current in 1955? The increased revenue has obvious benefits, whether as Government gathered taxes or as higher income for either the smallholder or for rubber companies. Unfortunately, rubber at a high price acts as a curb on replanting programmes, and more so for the smallholder who lacks capital reserves but with whom the need to replant is of the greatest urgency. In a like manner synthetic rubber production receives additional impetus from the wide price differential and already the erstwhile Government owned plants have settled down under private ownership to increased production.

For natural rubber the attractive glitter of an immediate higher income should not obscure the more solid gold of a secure long term future which will result from a continuous and planned programme of replanting.

The new forms of modified natural rubbers which are being developed point to the steady progress of fundamental and technological research. A new appreciation has arisen of cleanliness in factory practice and there are signs that bactericidal treatment of latex and equipment used in its preparation may produce more uniform supplies of high quality latex. Although south east Asia has not yet become infected an alerting campaign has commenced against the appearance of the leaf disease by which *Hevea* rubber trees have been very largely decimated in parts of South America. A major re-direction of research efforts is foreshadowed by the announcement that the Rubber Stichting is expected to be transferred—lock, stock, and barrel—from Delft to Bogor.

We could continue listing advancements, achievements and changes which are occurring in the natural rubber industry; we could compare them with similar successes by workers in synthetic rubber, noting that large scale manufacture of synthetic rubber has already commenced in the United Kingdom; and we would find our comparisons and weighings-up produce a query 'Are we doing enough?' It is in this mood that we leave our reader; appraisal and assessment of results are necessary in order to direct to the best possible advantage the effort that is available, whether in research or industry. The research worker awaits a decision and the final settlement of finance for future research and development work. And we repeat 'Are we doing enough?'.

Paper Bag Packing

IN AN ARTICLE DISCUSSING BARE BACK BALING of sheet rubber in *Planters' Bulletin 7* the history of events leading to that type of packing is described. The guiding influence in the change from packing in wooden crates to bare back bales has been a desire to cheapen the cost of packing and shipment. The dirt picked up in transit and inclusion of the fine coating powders on bales of lower grades of natural rubber has a relatively small influence on the final manufactured products. Even bales of higher grades of rubber such as RSS 1, air dried sheet and pale crepe are often used complete without the removal of wrapping sheets. When a particularly clean rubber is required, for instance, in cable making, surgical or adhesive uses, the inclusion of wrapping sheets with their bale coating and dirt content is deleterious to the finished article.

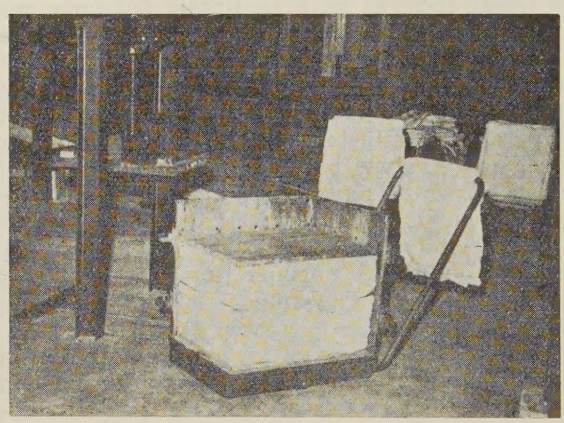
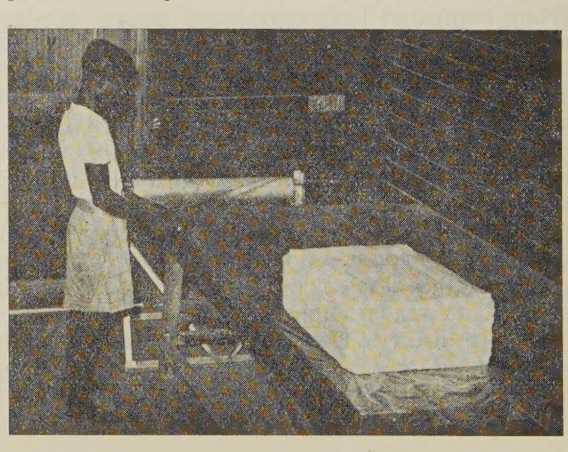


Figure 1. Two 80 lb bales after pressing in standard 250 lb R.S.S. baling box. Note the aluminium partition plate between the bales and the two crepe wrapping sheets on the box handle.

The wrapping sheets of the bale must either be discarded or subjected to a cleaning process before use. Such cleaning is expensive and costs as high as fifteen cents per pound of rubber have been reported.

To provide a suitable cheap wrapping which can protect rubber during shipment, the Rubber Research Institute of Malaya has sent numerous small trial shipments to England for examination at destination.

Figure 2. One 80 lb bale, after pricking the crepe wrapping sheets round the bale in both directions over the ends, is laid on polythene sheet from the spool at the end of the table and a set length of polythene is cut off.



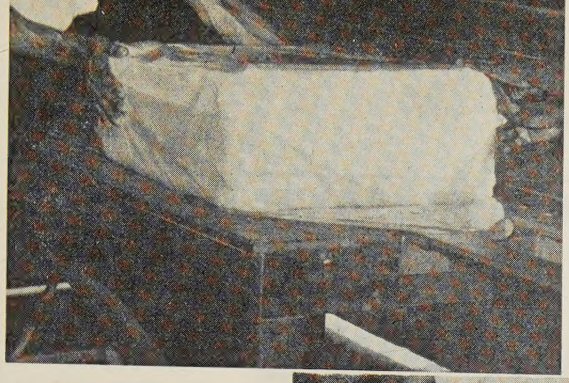
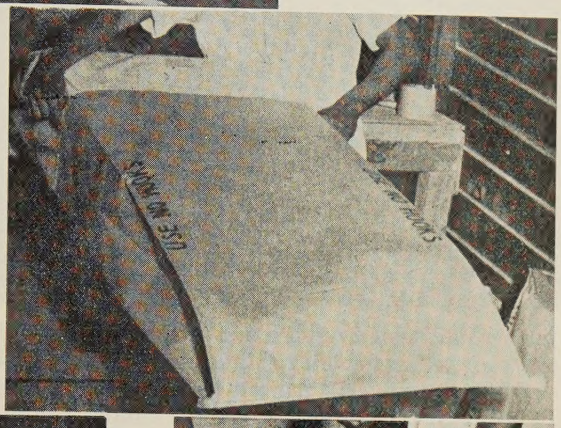


Figure 3. The bale covered with the polythene sheet is slid onto the pair of iron bars projecting from the end of the table.

Figure 4. A four ply multiwall paper bag is drawn over the bale.



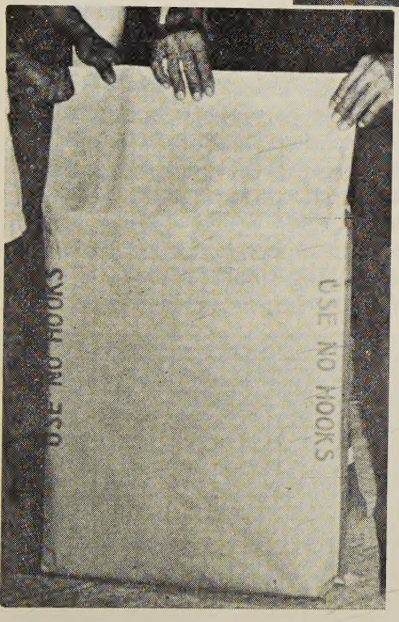


Figure 5. The bale and bag are slid off the iron bars and the bag pulled tight around the bale. Three pronged clasps are stapled into the long side of the open end of the bag.

Figure 6. The now stapled long side of the open end of the bag is folded over and three more clasps are stapled into both short sides. Note the clasps in the foreground and the stapling tool.

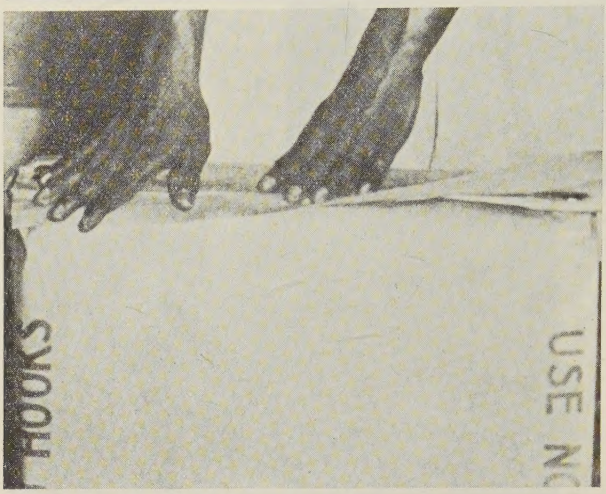


Figure 7. The long side of the now sealed end is finally protected with a strip of gummed paper.

These shipments have included bales of different shapes and sizes, packed and pressed in a variety of ways. Outer wrappings of paper bags, cardboard boxes, bituminised paper, jute hessian combined with liners have been tried; some of the more recent successful trials were those employing lined paper bags.

Efforts have been made by a Dutch company, Veth's Papierenzakken Fabriek N.V., to interest natural rubber producers in the shipment of rubber in paper bags. This company took up the problem from the fact that synthetic rubber is normally packed in multiwall bags of approximately seventyfive pounds weight and these bales are stacked, fork lifted or palletised in lots of half or one ton in consumers factories without difficulty. If this could be done for synthetic rubber why not for natural rubber? One of the problems involved in the use of paper bags is the necessity of using small bales. Research workers at the R.R.I.M. and elsewhere have considered that small bales would deform less in storage and handle better in ports and consumers factories. However, the trade has resisted the suggestion of packing small 70 or 75 lb bales because of the increased cost of packing the larger number of smaller bales, the increased charges for port handling, shipping and handling in consumers factories. At the 1955 Rubber Packing Conference in New York it was

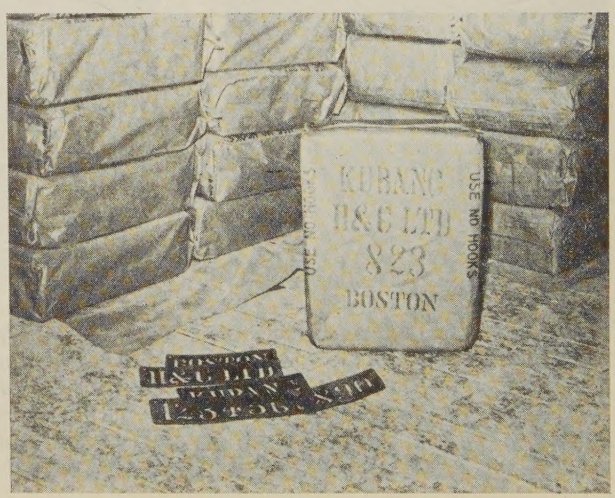


Figure 8. Stencilling the bale completes the packing operation.

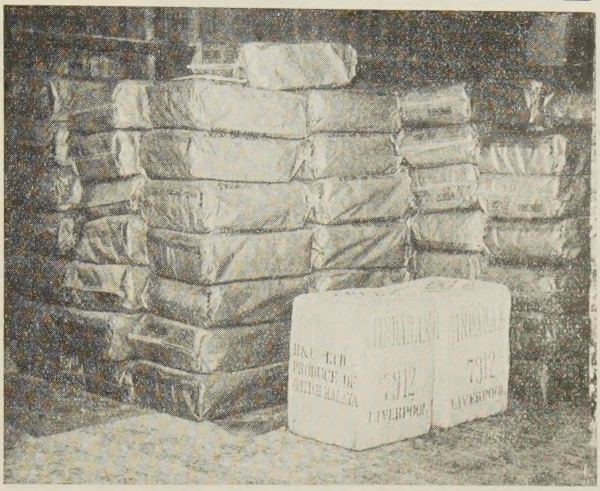


Figure 9. Bales are stacked in the estate packing shed prior to despatch. Note the two normal 186 3/4 lb bales of pale crepe, included for comparison.

stated that generally manufacturers in the United States did not want bales of weight smaller than 250 lbs for sheet rubber and of equivalent size but of less weight for some other grades. Elsewhere in the world the problem is similar but where factories are smaller and competition less fierce there is a little more interest in small bales.

Thus it has appeared that rubber packed in paper bags is of limited use except where a special advantage as mentioned above is obtained. Nevertheless the manufacturers of the paper bags have conducted experimental shipments of crepe and sheet rubber and have prepared a useful booklet describing the method of packing. Several descriptions of the methods have appeared in the technical press and the R.R.I.M. has been requested to express its views on the value of shipments of rubber in paper bags. Since the method of packing has been carried out on a commercial basis for some time the Institute undertook also to provide observers to study a commercial shipment. This article gives a description of the packing of a fifteen ton consignment of pale crepe in paper bags on an estate, despatch of the bales and shipment from Malaya and the condition of the bales after arrival in Boston U.S.A.

Figure 10. Bales are loaded on a trailer in the godown before moving to the dockside a short distance away.

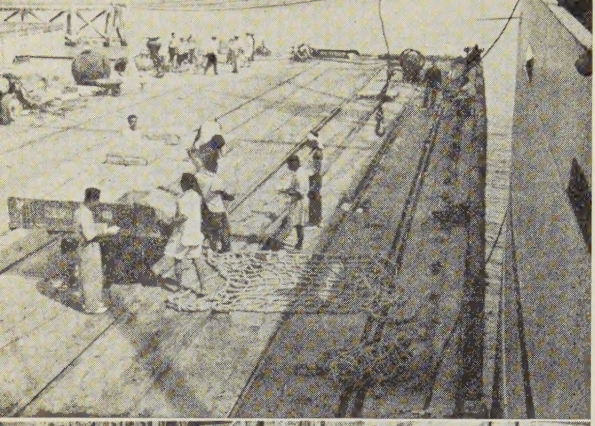


Figure 11. A general view of the first bales being loaded into a sling.

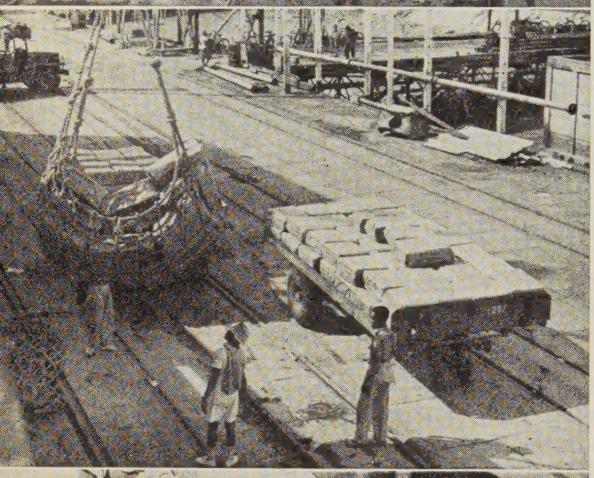


Figure 12. A full sling of 27 bales (nearly 1 ton) being lifted aboard during loading.

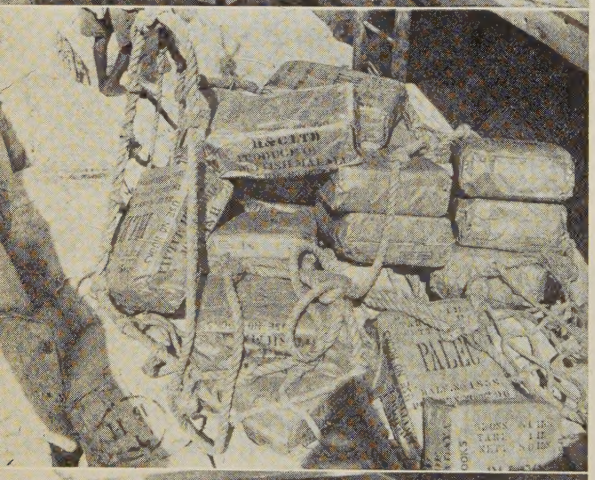


Figure 13. Bales are dropped into the hold, on top of a consignment of Siamese rubber.

Figure 14. The bales are manhandled into place and the condition of the stacking part way through the loading of the consignment is seen.

On the estate, No. 1 thin pale crepe was taken from the drying sheds, examined, clipped and cut into lengths in the usual manner prior to the manufacture of sole crepe. These lengths were folded and weighed into 80 lb lots. Two bales at a time were then pressed up to 24 hours in a normal RSS 250 lb capacity baling box. One hour was stated to be the minimum time for satisfactory pressing. The packing of the rubber is shown in *Figures 1* to *9*. It will be noted that a polythene liner is used to wrap the rubber before bagging. This is essential to prevent sticking of the rubber to the paper and allows easy removal of the wrappings at destination. The bags may be stencilled before packing which also eliminates considerable handling in the packing shed.

From the estate the bales were taken about forty miles to Port Swettenham by road, unloaded in a godown, stored for a few days and loaded on dock trucks for transport to the wharf. The bales were loaded into slings, lifted inboard and dropped into the hold on top of a consignment of Siamese rubber. The bags were then manhandled against a bulkhead. The bales, although given top of hold shipment were not resting upon an even foundation but merely on the uneven bale surfaces below. No special care was taken in loading, particularly on discharge into the hold. No bags were seen to tear or split and they appeared to be satisfactory in service. (*Figure 10* to *14*).

The bales were shipped direct to the United States in the s.s. 'Mandeville'. The unloading in Boston was watched by our associates from the Natural Rubber Bureau, Washington, and it can be seen from their photographs (*Figures 15* and *16*) that the bales on arrival in the dockside godown were in good condition and could readily be handled by mechanical equipment.

The bags are opened at the bottoms by pulling out the red thread of stitching. The bale slides out to allow sampling, after which the open end can be refolded and closed by stapling. The polythene bale wrappers were removed easily. This is unnecessary in a factory where the rubber is to be subjected to high temperature mastication since the polythene is inert and disperses into the rubber. If low temperature mastication only is being undertaken polythene wrapper removal is necessary because processing difficulties are encountered.

Figure 15. The bales after arrival in Boston U.S.A. showing legibility of marking and crepe unwrapped for sampling.

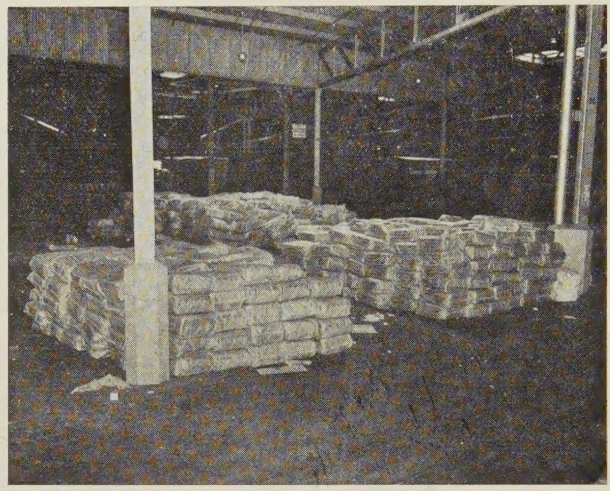


Figure 16. The complete consignment of bales in the Boston dockside warehouse showing the ease of stacking and good condition of the bales on arrival.

This shipment being described was made with upper hold stowage; previous shipments and experimental lots have usually been given this treatment since there is a marked tendency to treat paper packed rubber with more respect than bare back bales. We have been informed that some shipments have been made in lower holds and have usually been received in good condition. Only one report of serious tearing, removal of wrappings and obliteration of markings of paper bag shipments has been reported to this Institute; in this case it is understood that Veth's bags were not used. Markings, except in this instance, have always been legible in contradistinction to many bare back shipments.

A recent purchase of 100 Veth bags cost $1.33 Malayan per bag including import duty; this is equivalent to a cost of 1.66 Malayan cents per lb of rubber. No doubt purchase of larger quantities of bags will lower this cost a little. On estates there appears to be no increase in handling charges particularly after the packing staff has become expert in using the bag packing method.

CONCLUSION

Paper bag packing of rubber is applicable to most forms of natural rubber except sole crepe but is unlikely to become popular except where a definite advantage accrues to the manufacturer by the supply of small clean bales of rubber. A premium in excess of two Malayan cents per pound should cover the cost of bags and possible extra handling and shipping costs.

The paper bags consisting of four multiwalls of paper with a polythene liner have proved satisfactory; shipment using this type of bag can be recommended but preference for between deck stowage should be indicated. Advantages in handling and identification of these bales are established and their use should be encouraged where suitable.

Clonal Seed Collection

THE CURRENT REPLANTING PROGRAMME has created a heavy demand for clonal seed, supply is inadequate and will become more so. Therefore estates with stands of budded rubber, especially of Tjir 1, may profit by entering this market, or alternatively guarantee their own supplies. The quality of clonal seed can be ensured only at the time of collection. Seedlings of inferior families will pass undetected until disappointing yields are returned.

All trees obtained by budgrafting from one individual form a clone. Excepting mutations, which appear to be rare in *Hevea brasiliensis*, all parts above the union of trees of one clone have the same heredity. Only seed borne by budgrafted trees is correctly termed clonal seed. The trees grown from them are clonal seedlings. Although individual clonal seedlings are selected to found new clones, which may in turn prove to be good parents, the majority are not good parents. The progeny of open pollination between clonal seedlings are called second generation families, which are not clonal seedlings, but are inferior in yield, often being little better than unselected seedlings, and they cannot be recommended for planting.

The seed coat is derived from the tissues of the mother tree, and the seed shape is determined by the pressures exerted by the pod, which is also part of the mother tree. Thus all seeds borne by trees of the same clone are very similar, and the mother tree may be identified with reasonable certainty by the seed shape and markings. There is no way of recognising the pollen (or male) parent by examining the seed. After planting it is impossible to discover the origin of clonal seedlings or differentiate them from unselected seedlings.

Hand pollination is the only method of knowing both parents of a seed with certainty. However, if seed is collected from a monoclone block isolated from other rubber it is almost definitely the product of self-fertilisation within the clone. Certain clones, such as Pil B84, are not very self-fertile and if growing near another clone, *e.g.* Tjir 1, most of the seed set by the Pil B84 would be Pil B84 × Tjir 1.

With the notable exception of Tjir 1, selfed seed is usually inferior in vigour and yield. It is unfortunate that selfed seed of the very self-fertile PB 86 is an inferior family and cannot be recommended.

The majority of clones including Tjir 1 are only partly self-fertile. The seed set is increased after flowering in the proximity of other trees which serve as pollen parents, and this increase is presumably entirely due to the products of cross fertilisation. This cuts two ways. The presence of another good seed parent in a mixed planting or along a boundary will increase the seedfall and yield a family of superior quality. But the presence of a few unselected seedlings or other rogues of unknown and probably inferior value as seed parents will also increase the seed fall. Hence the contamination of a good clonal seedling family by inferior pollen is much higher than the proportion of rogues present in the stand.

The selfed seedlings and some crosses of Tjir 1 have been tested extensively throughout Malaya. The yields are only slightly less than the production by the highest yielding proven isolation seed garden families. The Tjir 1 families have satisfactory vigour and bark renewal, but

suffer from the same disadvantages as other clonal seedlings, namely that they yield less than the higher yielding clones and have a marked susceptibility to brown bast.

Tjir 1 has been budgrafted on many estates and therefore provides the most readily available seed source of proven quality. Adherence to the following recommendations is essential to prevent dissemination of degraded planting material and subsequent long term detriment to the industry. Particularly, smallholders and small estates must be able to rely on the integrity of their more fortunate neighbours for good planting material.

No seed should be collected within five chains of any seedling rubber. This applies to both unselected and clonal seedlings, whether planted in stands or occuring as rogues in budded areas. Therefore a boundary belt of five chains surrounding the seed collection area must be free of all seedlings. If seed is to be collected up to the edges of a Tjir 1 block, this belt free of seedlings must extend for a depth of five chains into any surrounding budded rubber. Also any volunteer rubber seedlings in belukar or jungle borders must be eradicated.

Seed collected from monoclone blocks of Tjir 1 with no other rubber within five chains may be described as Tjir 1 selfed seed. It is safe to collect up to the boundaries of Tjir 1 with budded areas of most high yielding clones and known good seed parents, for example AVROS 157 and Tjir 16.

After delimitation of a suitable seed collection area and the removal of all seedling rogues, the covers should be slashed back to allow ease of movement. All old seed on the ground should be removed and destroyed. Then collections must be made at regular intervals of not more than one week so that only fresh seed is taken. When seed fall is heavy collections may be made more frequently, even daily.

The Institute offers the following services to assist in the production of good quality seed. The staff of the Botanical Division will advise on the suitability of an area for seed collection on receipt of scale plans showing the materials employed and dates of planting in the proposed area and its surroundings.

A rough appraisal of seed quality may be made by sorting the seed according to mother trees. A sample of one pound weight per acre should be collected in the following manner. Seeds are picked up one at a time throughout the whole area. If the density is about 100 trees per acre, this could be done by picking up one seed from beneath each tree. No sorting should be undertaken before the sample is sent in. On receipt of this sample the Botanist will identify the mother trees as far as possible. Such a sampling will only give a first opinion on the presence or absence of rogues or the suitability of the seed and is no substitute for careful inspection of trees by a skilled mandor, who can identify and mark the actual rogues which must be removed. However, this sampling does indicate whether or not an area is worth considering for seed collection.

Normally the mandors can only be released to identify sources of budwood, but the urgency and importance of improving the seed collection areas is so great that they will be made available for this work

also at the usual charges. With the flowering season now rapidly approaching, it is imperative that requests be sent in at once so that tours of estates can be arranged. Requests should be accompanied by a plan of the area. Before a mandor's visit undergrowth should be slashed back to permit free movement. Paint should be provided to mark all rogues clearly. This will enable any interested party to visit the area and be satisfied that all such rogues have been cut out prior to flowering. Incidentally unwanted rogues should not be poisoned because of the risk of poison transmission by natural root grafts to other trees.

Clonal seed quality can be preserved only by the identification and removal of all seedlings rogues and strict adherance to the recommended limits of collection.

Tapping Prior to Replanting

AN EARLIER ARTICLE ON THIS SUBJECT appeared in *Planters Bulletin 15*, (page 103), and results are now published from estates where the recommended high intensity tapping systems, with periodical yield stimulant applications, have been used on a commercial scale. These results cover observations made on five different estates, and have been made available by the courtesy of Messrs Edgar and Shearlaw.

In every instance the old trees had been tapped on half circumference alternate daily 100%. Prior to intensive tapping, they were then tapped high on a half circumference cut at 100% intensity, with a yield stimulant applied at six monthly intervals.

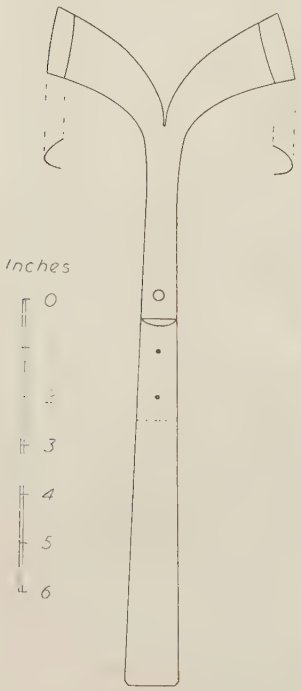
During the final year of life the recommended systems of intensive tapping were adopted, with two cuts on the virgin bark, and one or if possible two cuts on the renewed bark. All cuts were tapped on the same day, and the intensity was maintained at 200%. To maintain this intensity when three cuts were employed, tapping was third daily, and when four cuts were employed, tapping was fourth daily.

When possible the two cuts in the virgin bark were tapped in an upward direction, but if this was not practical by reason of previous ladder tapping, the original ladder tapped cut was continued downwards, and the new cut upwards. A yield stimulant was applied at four monthly intervals to the high cuts only.

On two estates very good results were obtained by using one upward cut at 100% intensity prior to more intensive tapping. An experiment is now in progress to determine the length of time upward tapping can be continued, and the amount of bark consumption. It has been already found that the arms of the V-cut should be steeper than 35° from the horizontal.

At this stage it should be made clear that high intensity tapping systems result in controlled increases in intensity, and although equivalent to what is commonly known as 'slaughter' tapping, they should be kept under control and not allowed to degenerate into careless work leading to heavy bark consumption and waste of stimulant.

A new knife has been developed especially suitable for upward tapping. Mr. A.T. Edgar has proposed that it be named the 'Kanoor' knife, after the inventor. A diagram and photograph of the 'Kanoor' knife are shown.



A summary is shown in the TABLE of the yield records from the five estates, and from the figures it is clear that although there is variation in response to treatments, yet the efficacy of the tapping systems recommended in our earlier article is confirmed.

It is stressed once again that application of a yield stimulant requires great care if damage to the trees is to be avoided. To determine the correct depth of scraping on virgin bark, the dead cork is first removed, then a greenish layer, and finally a smooth yellowish layer. This is the correct depth and is confirmed by the presence of coarse reddish tissue and by the appearance of minute drops of latex. The stimulant must not be applied until these drops have dried up, when it should be painted thinly and evenly on the exposed bark.

Too thick a layer of the stimulant causes excessive burring of the bark. Scraping and treatment of a strip wider than three inches, which is not then tapped off within three months; or failure to tap off a three inch treated strip in three months, also results in burring and cracking of the bark.

YIELDS ARE EXPRESSED IN POUNDS PER ACRE PER MONTH

Previous yield level	Estate I		Estate II		Estate III		Estate IV		Estate V
	Ladder tapping V/2.d/ 2.100 %	*Intensive tapping* 3V/2.d/ 3.200 %	*Ladder tapping* V/2.d/ 2.100 %	*Intensive tapping* 4s/2.d/ 4.200 %	*Ladder tapping* V/2.d/ 2.100 %	*Intensive tapping* 3V/2.d/ 3.200 %	*Upward tapping* V/2.d/ 2.100 %	*Intensive tapping* 3V/2.d/ 3.200 %	*Upward tapping* V/2.d/ 2.100 %
	33.0	31.3	33.0	30.7	39.0	41.0	38.3	36.4	28.7
1st month on new system	92	62	50	23 +	74	81	77.4	75.4	62.4
2nd month on new system	88	130	62	102	64	86	109.5	81.3	61.4
3rd month on new system	77	123	67	87	44	82	95.0	65.6	65.8
4th month on new system	62	95	48	70	48	78	58.0	62.0	78.0
5th month on new system	65 ×	85	45 ×	82	28 ×	95	60.0 ×	84.5	79.8
6th month on new system	50 ×	92	35 ×	76	38 ×	84 ×	59.0 ×	70.0	58.9
7th month on new system	65	89	65	79	56	72 ×	104.0	49.0	54.0 ×
8th month on new system		63		48		85		58.0	62.7 ×
9th month on new system		72 ×		46 ×					85.9
10th month on new system		59 ×		38 ×					
11th month on new system		67		47					
Mean	71.3	85.2	53.1	63.5	50.3	82.9	80.4	68.2	67.7
Mean as percentage of pre-treatment yield (100 %)	216.1	272.2	160.9	206.8	129.0	202.2	209.9	187.4	235.9

\+ *Opening up of high cuts*

× *Denotes months of March and April (effects of wintering)*

Planting Density

THE EFFECTS OF PLANTING DENSITY have been studied in a 40 acre experiment at the R.R.I. Experiment Station in which six planting densities were compared, ranging from 50 trees per acre to over 400 per acre. The trial was budded in 1930 with clone AVROS 50 and since then no thinning has taken place apart from small involuntary losses due to disease or damage. Tapping on system S/2.d/2.100% has continued since 1936, and is now in progress on second renewed bark. The following discussion is confined, however, to the performance during the first 16 years of tapping corresponding to two complete cycles of tapping.

The influence of planting density on growth was not evident until the fourth year of age (from budding) when competition developed, but thereafter growth was retarded in the denser plantings. By 20 years of age trees planted at 50 per acre had a mean girth 50% greater than those at 200 per acre and nearly double those at 400 per acre.

A low density of 50 per acre attained over 90% tappable trees during the third year of tapping and thereafter the percentage changed only slightly. But with a density of 400 per acre, one third of the trees never reached tappable size and only after about seven years tapping did the tappable proportion reach 60%.

The trial suffered only slight wind damage and root disease, and brown bast incidence was small. The proportionate losses showed no clear association with planting density.

On the completion of the first cycle of tapping on the first panel (nine years after budding), virgin bark thickness was about three millimetres more (or nearly 50%) at a density of 50 per acre than at 400 per acre. This virgin bark difference had increased to about 70% on completion of the second cycle of the same panel at 18 years after budding. First and second bark renewal was also greater at the lower planting densities, but when expressed as a percentage of the corresponding virgin bark it was unaffected by density.

The dry rubber content of the latex decreased slightly with increased planting density but the effect amounts to a reduction of only 0.02 d.r.c. percentage units per increase of ten trees per acre.

During the first year of tapping only small differences in yield per tree were observed between the different densities, but thereafter marked differences steadily developed, and by 20 years of age trees planted at 50 per acre had an average annual yield per tree nearly five times as great as those at 400 per acre.

The lowest planting density (50 per acre) has consistently produced the lowest yield per acre. During the first four years of tapping the greatest annual production per acre was from a density of about 200 trees per acre. It was then overtaken by the highest planting density (about 400 per acre) which remained slightly superior up to the completion of the second cycle of tapping on both panels (say 22 years of age). Cumulative yields per acre up to this stage show that a density of 400 per acre accumulates about ten per cent more than a control density of 200 per acre, whereas a density of 50 per acre gives 30% less than this control.

There is evidence of a small increase in the percentage of lump and scrap with increased planting density, but the effect is too small to constitute a significant economic factor in the choice of planting density.

From a study of tapping times it is estimated that the tapping costs per acre at a density of 50 per acre are only about 40% of those at 200 per acre, whereas those at 400 per acre are about 150%. Relative tapping costs per lb are less varied.

Certain assumptions are needed to apply these results to the problem of deciding the most profitable estate planting density. In practice initial planting densities are thinned to introduce selection, whereas in this experiment no voluntary thinning was undertaken, and indeed the choice of a thinning scheme for different densities would have partly presupposed the final outcome of the trial. The following TABLE I has been derived by interpolating in the results obtained with the six densities of the trial. The tappable stand per acre corresponding to each planting density is the number of trees per acre in tapping after stable conditions have been reached. It will later be assumed that the relative performance of these tapped stands is not markedly affected by the presence of small untappable trees. The yields per acre and the tapping costs are expressed as a percentage of those obtained with a tappable stand of 100 trees per acre. These relative yields are derived from cumulative yields produced during the first two cycles of tapping; the relative tapping costs per acre are obtained from relative tapping times, and the relative tapping costs per lb are calculated from relative yields and relative costs per acre.

TABLE I: RELATIVE YIELDS AND TAPPING COSTS

Number of tappable trees per acre (No thinning)	*Planting density per acre*	*Relative yields per acre*	*Relative tapping costs*	
			per acre	*per lb*
		(Expressed as a % of 100 tapped trees/acre)		
		%	%	%
50	54	83	63	76
75	84	92	81	88
100	116	100	100	100
125	150	108	118	110
150	186	113	139	123
175	227	115	160	139
200	273	117	181	154
225	322	119	201	169
250	386	121	222	183

Changes in tappable stand per acre affect relative yields per acre less than relative tapping costs.

There are several costs apart from tapping which are affected by the tapped stand, for example planting, budding, maintenance, processing and packing costs, and capital outlay on labour accommodation are all affected to some extent; and generalisation about these effects is difficult. However, tapping constitutes the major single cost item, and an

approximate estimate of the tappable stand required to produce the maximum profit per acre has been derived by assuming that costs per pound other than tapping are not grossly affected by the choice of tappable stand.

A further difficulty is that the choice of the most profitable tapping stand will depend on the price received and production costs, including tappers' wages, prevailing throughout the economic life of the trees. These are not readily forecast, and if they were the information might be put to more powerful use than merely a decision on optimum stand. However, the interrelation of these items is perhaps less problematical.

It can be shown that the most profitable stand per acre is a function of the index, K,

where $K = \frac{t}{s\text{-}q}$

and t = tapping costs in cents per pound at a control stand of 100 tapped trees per acre

s = price received in cents per pound

q = costs other than tapping in cents per pound (assumed to be largely independent of tapped stand per acre).

Estimates of the most profitable tapped stands are given in TABLE II for different values of the index K.

TABLE II: OPTIMUM TAPPED STAND

Value of index K	0.05	0.10	0.15	0.20	0.25	0.30	0.40	0.50	0.60	0.70
Optimum stand per acre	265	175	155	145	135	130	110	65	40	*less than* 25

For example, if it is forecast that the average price received per pound will be eightyfive cents, that all production costs other than tapping will total thirty cents per pound, and that the tapping cost of the particular material at a tapped stand of 100 trees per acre will be twenty cents per pound,

then $K = \frac{t}{s\text{-}q} = \frac{20}{85\text{-}30} = 0.36,$

and from TABLE II the tapped stand giving the maximum profit per acre is estimated at about 120 trees per acre.

This method of relating optimum stand to tapping costs per pound at a tapped stand of 100 per acre is fairly convenient since the control stand is common on Malayan estate plantings; the optimum stand could equally be related to a more absolute definition of tapping costs such as cost per task, but the relationship would not be the same for material of different yield capacity.

Clearly if tapping costs per pound are relatively low compared with selling prices, it is advantageous to aim at a relatively high tapping stand. But when costs per pound are high, as with poor yielding material, then a lower tapping stand is preferable.

Having chosen the optimum stand with the aid of assumptions and a long term forecast of prices and costs, it remains to consider at what

density the trees should be planted so as to achieve this. In the example given, the optimum stand for tapping was 120 trees per acre, and from the trial results with clone AVROS 50 we know that it would require an initial planting density of about 150 per acre to obtain this without thinning. In practice with a planned thinning programme the removal of untappable trees would improve the performance of the remainder, but it would be advantageous to adopt a higher planting density than 150 so that a greater degree of selection can be exercised and as an insurance against unexpected damage during immaturity. This extra density at planting will depend on planting costs and the variability of the material, but as a generalisation a planting density of 180 is suggested if the ultimate aim is a tapped stand in the region of 120 trees per acre.

This figure of course applies to a budded stand only, and with the uniformity of such a stand the suggested maximum of 180 trees per acre permits the thinning of the grafts growing on poor stocks, disease affected trees and those affected by other natural causes. It is obvious that natural causes will always produce a small annual wastage, and our suggestion is that the stand of 120 per acre should occur in the tenth year of life to coincide with the onset of the optimum period of production. Seedling families are more variable, and more thinning is required to weed out runts and unproductive trees. We consider that stands of over 200 to the acre should be suitable for this purpose.

A communication in the *Journal of the R.R.I. of Malaya* will present the results of this planting density experiment in more detail and will amplify the discussion of the assumptions used, but it is clear that no simple, hard and fast generalisation can be made about the most profitable planting density. All that can be claimed for the present recommendations is that they are considered to be roughly of the right order under the prevailing relationship of tapping costs and selling price.

Stimulant Treatment—A Caution

Tapping of high cuts may result in precoagulation of the latex and a certain proportion of downgraded bubbly sheet. More pronounced effects have sometimes been observed when high cuts are treated with a stimulant; it should be emphasised, however, that the use of stimulants on normal tapping cuts results in completely satisfactory latex and sheet.

The longer passage over the bark, the longer time of latex flow and the higher content of non-rubbers all contribute to a higher bacterial population in the latex from high cuts. When this occurs it is advisable to segregate such latex and to use formaldehyde as an anticoagulant in the tapping cup. The amount of formaldehyde required (up to 0.08%) exceeds the normal quantity and its use results in a dark coloured sheet.

R. R. I. News

In April, Dr A. Newsam, Head of the Pathological Division, paid visits to workers concerned with natural rubber research in America. Central America and South America. His tour included Hawaii, Washington, D.C., Miami, Florida and research stations in Brazil, Costa Rica, Guatemala and Peru.

Correspondence

The Editor invites the offer of brief letters for publication. Comment and queries arising from articles in PLANTERS' BULLETIN *are welcome.*

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THE IMPORTANCE OF ROADS

The statement is made in 'Manual of Rubber Planting' by A.T. Edgar (first published in 1937 and reprinted in 1947) that 'a well designed system of estate roads and paths will prove to be a considerable factor in reducing the cost of production'. Most rubber estates in Malaya have been developed without such planning and a consequent loss of efficiency must be expected.

Roads in the older estates which were opened up thirty to forty years ago were designed for slow moving traffic—bullock carts and pedestrians — but with the development of motor vehicle traffic and the ready availability of modern road building equipment, the lay out of modern estate road system can be designed on a new basis.

The major consideration should be quick communication using the shortest routes. Estate headquarters should be connected to the nearest outside main road by the shortest possible link, and the more important internal roads should also be short, *e.g.* between divisions, the office, factory and bungalow.

A clear and helpful picture of the position can be obtained by marking on a map (*e.g.* red circle) important centres such as outlying bungalows, labourers' lines, latex collecting points, and joining these main features to the central site with straight lines. From this diagram and by close examination on the ground of the natural obstacles, the minimum amount of deviation from straight line routes which can reasonably be achieved can be worked out, using bulldozer and road grading equipment for building the roads.

Secondary tracks and field paths can next be considered. They are of vital importance to the efficient maintenance of the estate and the collection of latex.

For the supervising staff, from the manager to the field overseers, ready access to every part of a field is essential. For the tappers, there must be good tracks for moving quickly to their task and for returning safely without the risk of slipping with full buckets of latex. Jungly tracks are a strong deterrent to the tapper and to his supervisors from carrying out their respective duties properly.

Clean tree rows and cross paths will assist considerably towards speeding up work and maintaining the standard of tapping. Whilst much must depend on the lie of land and the shape of tapping tasks, a good system of field paths is one where they radiate from latex collection points.

Finally, where a replanting project requires a better access route, new roads and paths should be put in along the lines indicated above without hesitation if the new area can thereby be reached more quickly. Money, time and trouble expended on devising and making new short routes, will be well repaid.

M.E.R. Jansen
c/o Post Office
Kluang

Our correspondent draws attention to an aspect of estate management which is often overlooked—Editor

Temporary Binding Case for Planters' Bulletin

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Courses for Senior Estate Conductors

Refresher courses for senior estate conductors are offered this year at the R.R.I. Experiment Station during 9 April to 14 April, 23 April to 28 April, 4 June to 9 June and 18 June to 23 June. Ten conductors can be taken on each course; they must be senior experienced men who are actually in employment, and all applications must be made by the managers of the estates concerned.

The programme will be mainly field work. Demonstrations, talks and lectures will include replanting and new planting procedures, weed control, establishment of legume covers, budgrafting and care of budded stumps, pests and disease treatments, manuring, tapping systems and yield stimulation.

Please apply early, to the Director.

OUR COVER ILLUSTRATION SHOWS A HILGER 'UVISPEK' PHOTOELECTRIC SPECTROPHOTOMETER WHICH IS ONE OF THE NEWER AIDS TO INVESTIGATION OF THE GROWTH OF BACTERIA IN LATEX AND INTRICATE CHEMICAL ANALYSIS.

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